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FRIDAY, FEBRUARY 1, 1895.

CONTENTS :

<i>Proceedings of the American Physiological Society :</i>	
WARREN P. LOMBARD, Secretary	113
<i>An Inherent Error in the Views of Galton and Weismann on Variation :</i>	
W. K. BROOKS	121
<i>Current Notes on Anthropology (III.) :</i>	
D. G. BRINTON	126
<i>Tchébychev :</i>	
GEORGE BRUCE HALSTED	129
<i>Scientific Literature :—</i>	131
<i>Poincaré's Les oscillations électriques (II.) :</i>	
M. I. PUPIN. <i>Ewing's The Steam Engine :</i>	
R. H. THURSTON. <i>Rudorff's Chemical Analysis :</i>	
EDWARD HART.	
<i>Notes and News :—</i>	137
<i>Paleobotany ; A Topographical Atlas ; Bibliography of American Botany ; General.</i>	
<i>Scientific Journals :</i>	139
<i>New Books :</i>	140

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PROCEEDINGS OF THE AMERICAN PHYSIOLOGICAL SOCIETY.

The American Physiological Society held its Seventh Annual Meeting in Baltimore, Md., December 27th and 28th, 1894. The mornings were devoted to the reading of papers, and the afternoons to demonstrations and to visiting the laboratories of Johns Hopkins University. The success of the meeting was largely due to the hospitality of Johns Hopkins University, the University Club and friends of the Society residing in Baltimore.

ELECTION OF NEW MEMBERS.

DR. A. C. ABBOT, First Assistant at the Laboratory of Hygiene, University of Pennsylvania.

DR. G. CARL HUBER, Assistant Professor of Histology and Embryology at the University of Michigan.

DR. P. A. LEVENE, of New York City.

DR. FRANZ PFAFF, of Boston.

ELECTION OF THE COUNCIL FOR 1894-95.

H. P. BOWDITCH, *President.*

R. H. CHITTENDEN.

W. H. HOWELL.

F. S. LEE, *Secretary and Treasurer.*

W. P. LOMBARD.

Reading of Papers and Demonstrations by Invited Guests and Members of the Society.

On the Occurrence of Diethyl Sulphide in the Urine of the Dog, with a Demonstration of Reaction for the Detection of Alkylsulphides of the Series $(C_nH_{2n+1})_2S$. J. J. ABEL.

Dr. Abel demonstrated in a series of reactions, many of them new, that the volatile, odoriferous compound that is liberated when dog's urine is treated with alkalis is ethyl sulphide $(C_2H_5)_2S$, and also that the organic sulphides of the series $(C_nH_{2n+1})_2S$ may readily be detected, wherever found, with the help of his reactions.

On the Use of the Trichloride of Acetic Acid as Anæsthetic for the Laboratory, with Some

Account of its Fate. J. J. ABEL and T. B. ALDRICH.

Drs. Abel and Aldrich gave an experimental demonstration of the use of the solid trichloride of acetic acid of Willgerodt, the so-called acetone chloroform, as an anæsthetic for the laboratory, with an account of its physiological action and of its fate, from a chemical point of view, in the economy.

Demonstration of Instances of Experimental Cachexia Tyreopriva in Dogs. J. J. ABEL and A. C. CRAWFORD.

Drs. Abel and Crawford showed a number of dogs whose thyroid glands had been removed. They also gave an account of their results in treating the diseased conditions thus induced, and outlined the methods and aims of a research on the functions of the thyroid gland.

Equilibrium in the Crustacea. G. P. CLARK.
(Introduced by F. S. LEE.)

Dr. Clark stated that he had studied two kinds of crabs, the 'Fiddler,' *Gelasimus pugilator* (Latr.), and the 'Lady,' *Platyonichus ocellatus* (Latr.). The former is an active runner, the latter an active swimmer. The movable eyestalks show marked compensating movements when the body is inclined. The compensating positions are maintained without reaction so long as the inclination of the body continues. No compensating movements accompany turning around the vertical axis. The otocysts contain no otoliths. Removal of both antennules, inclusive of the otocysts, caused no abnormal position of the body and no forced movements, but was followed by a tendency of the 'Fiddler' crab when attempting to run, and of the 'Lady' crab when attempting to swim, to roll over on to the back. A similar tendency has been observed by others in the crayfish and dogfish after removal of the otoliths. Removal of both antennules was followed by no abnormal position of eyestalks, but by marked diminution

of their compensating movements. Removal of otoliths from both ears of a dogfish is reported to be without effect on position of eyeballs, but to cause a loss of the *maintenance* of compensation which is observed in those rotations which involve inclination of the body. Compensating eye movements in the crab occur only in those planes in which in the dogfish the compensation is maintained, and loss of corresponding structures in these animals tends to destroy compensation in the one and the maintenance of compensation in the other. In many cases it was found that a small amount of compensation remained after the 'Fiddler' crab had lost both antennules; if eyes were then covered with a thick black mixture it was completely stopped.

Galen's Technical Treatise upon Practical Anatomy and Experimental Physiology. J. G. CURTIS.

Dr. Curtis spoke upon Galen's technical treatise on practical anatomy and experimental physiology, usually cited as '*De anatomicis administrationibus*.'

This was written between A. D. 150 and 200, and is the earliest existing technical treatise upon these subjects.

The Greek text of Books I. to VIII., and of part of Book IX., is extant in print, and also Latin translations of the same.

The rest of the work, viz., the latter part of Book IX., and Books X. to XV., is inedited, and is contained only in two MSS. of an Arabic version of the 9th century, attributed to HONAIN IBN ISHAK or to his nephew HOBACH.

One of these two MSS. is at the Bodleian Library at Oxford. By the kindness of the authorities, Books IX. to XV. of this MS. have been photographed for Dr. Curtis, who is also, through the good offices of the late DR. GREENHILL, of Hastings, England, in possession of an inedited MS. sketch of a translation of these books into French, by the late M. GUSTAVE DUGAT.

Dr. Curtis proposes to edit, and to have published, a translation into English of the entire treatise, the Greek portion to be translated by himself, and the inedited Arabic portion by a collaborator not yet named.

This English translation will be the first complete edition of the 'epoch-making' Galenic work in question published in any language since the invention of printing.

The Normal Defect of Vision in the Fovea.

MRS. C. L. FRANKLIN. (Introduced by H. P. BOWDITCH.)

König's announcement, in May, 1894, that the relative absorption by the visual purple of the different portions of the spectrum is in very close coincidence with the relative brightness of the different portions of the spectrum, (1) for the totally color-blind, and (2) for the normal eye for faint light after adaptation (with the obvious inference therefrom that the vision of the totally color-blind and that of the normal eye in a faint light was conditioned upon the presence of the visual purple in the retina), made necessary some assumption to take account of the fact that in the fovea, which is the portion of the retina where vision is most acute, no visual purple has hitherto been found. Two assumptions were possible, either that the cones (and hence the fovea) do contain visual purple, but that it is here of such an extremely decomposable character that it can never, no matter what precautions are used, be detected objectively; or, that vision does actually not take place in the fovea under the above circumstances (that is, for the totally color-blind and for the normal eye at such intensities as are visible only after adaptation). As I had already made the prediction that total color-blindness consists in a non-development of the cones of the retina (*Ztsch. f. Psych. u. Phys. der Sinnesorgane*, Bd. IV.) and also that the adaptation which renders vision possible after twenty minutes in a

faint light is conditioned by the growth of the visual purple (*Mind*, N. S., III., p. 103), both predictions being naturally suggested by my theory of light-sensation, I was most anxious to put the latter assumption to the test. I therefore undertook to determine, in the dark rooms of Prof. König's laboratory, the threshold for light-sensation for different parts of the retina and for different kinds of monochromatic light.

The blindness of the fovea for faint light did not at once reveal itself; the act of fixation means holding the eye so that an image falls on the part of the retina best adapted for seeing it, and hence it would involve keeping the image *out of* the fovea in a faint light, if the fovea were really blind in a faint light. But after the total disappearance of the small bright object looked at had several times occurred by accident, it became possible to execute the motion of the eye necessary to secure it at pleasure. It was then found that the simple devices of presenting a group of small bright objects to the eye of the observer was sufficient to demonstrate the 'normal night-blindness of the fovea' (as it may best be called) without any difficulty; one or the other of them is sure to fall into the dark hole of the fovea by accident. It was only by means of this arrangement of a number of small bright spots that the total blindness of the totally color-blind boy in the fovea could be detected; he had, of course, learned *not* to use his fovea in fixation. Professor König then proceeded to demonstrate the total blindness in the fovea of the normal eye to blue of about 470.*

[These experiments upon the normal eye were exhibited.]—It was shown that König's proof that the pigment-epithelium

*Professor v. Kries is said by Professor Gad to have shown that the experiments in question do not establish the blue-blindness of the fovea (*Berichte der Naturforschenden Gesellschaft zu Freiburg*, IX., 2. S. 61). I have not yet had access to this criticism.

is the only layer of the retina which is affected by red, yellow and green light is not wholly conclusive. The interpretation of the new facts and their bearing upon several theories of light sensation were discussed.

[This paper will appear in full in *The Psychological Review* for March, 1895.]

The Influence of low Percentages of Alcohol upon the Growth of Yeast. C. F. HODGE.

The influence of decomposition products upon cellular metabolism is a question of wide physiological interest and has increased in significance since the advancement of recent theories regarding autointoxication. Do the decomposition substances of initial activity stimulate the cells to more active metabolism? Aside from the general question of the physiological effect of alcohol upon cellular processes, the influence of alcohol upon the cell which produces it would seem to be one of the best instances upon which to test the theory of autointoxication. Yeast can grow in a saccharine solution until by the decomposition of sugar it has brought the alcohol content of the liquid up to 14%. With a greater amount of alcohol no growth is possible. Flügge also states that at 12% growth is hindered. Experiments were made with exceedingly attenuated pure cultures in large amounts of nutrient solution, containing from .01%, .1% up to 14%. Counts were made as often as possible during the first three days. The general result up to the present is that yeast grows nearly twice as fast in pure solution as in 1% alcohol. An average of nine experiments thus far give the following figures representing proportional growth in the various cultures.

Growth in: 0%, 1%, 2%, 3%, 4%, 5%, alcohol.
77, 45, 16, 1.5, 0.3, 0.11.

Beyond 5% no growth appreciable by the method employed occurred within the three days. In cultures containing 0.1% and 0.01% growth was considerably less than

in the normal solution; but it is desirable to experiment further before giving the figures. As yet no evidence in favor of autointoxication theories has been obtained.

A Means of Recording Daily Activity of Animals and the Influence upon it of Food and Alcohol. C. C. STEWART. (Introduced by C. F. HODGE.)

Thus far the animals experimented on have been rats, mice and squirrels. They are kept in circular, easily rotated cages, so arranged that any motion of the animal rotates the cage, and by means of a tambour or levers this motion of the cage is recorded upon kymograph paper kept moving night and day. An electromagnetic circuit with a clock marks hours and minutes. We thus have the manner in which an animal divides his time between rest and activity recorded by himself. Rats and mice divide their days into about 12 hours rest and 12 hours intermittent work during the night. During the work period, short intervals of activity, rarely exceeding an hour, are interrupted by almost equal periods of rest. The squirrel, in winter, works almost continuously for from twenty minutes to two hours early in the morning, with sometimes a short interval of activity late in the evening, and rests nearly 22 hours in the day.

Food has a most marked influence upon diurnal activity. In general the richer the diet in proteid, the greater the activity. Fat has the opposite effect, reducing the activity of mice from 6 to 8 hours' actual work to a few minutes a day. To test the influence of alcohol on spontaneous activity, rats kept on dry corn were given instead of water alcohol of from 5% to 60%. During 50 days of his treatment, no uniform effect of the alcohol could be demonstrated. All normal animals experimented on tended to work more minutes per day, when barometric pressure was high, and this must be taken into careful account in estimating the effect of any condition upon daily activity.

A Study of the Operative Treatment for Loss of Nerve Substance in Peripheral Nerves. G. CARL HUBER. (Introduced by W. P. LOMBARD.)

The report covered the results obtained in 50 experiments on dogs, in which the various methods that might be employed in the surgical treatment of divided peripheral nerves, where there is loss of nerve substance to the extent that an ordinary suture cannot be made, were tried. Segments varying in length from 5–8 cm were removed from the ulnar and sciatic nerves of the dogs. In 26 experiments a portion of another nerve (usually the sciatic of a cat) was implanted between the resected ends of the nerve operated upon, and retained in place by means of sutures; in 8 experiments the resected ends were united by means of decalcified bone tubes; in 7 they were united with a number of catgut threads; a flap from the peripheral end of the central stump was made in 7 experiments; and grafting the central end of the peripheral portion of a resected nerve to an accompanying nerve trunk was tried twice. After carefully closing the wounds, the animals were allowed to live for periods varying from 2 to 182 days; before killing the animals the nerves operated upon were tested as to their conductivity; they were then removed and prepared for histological examination.

1. In all experiments the peripheral portion of the divided nerve degenerated, as also $\frac{1}{2}$ cm. of the distal end of the central stump.

2. Regeneration was obtained after implantation of a nerve segment, tubular suture and suture *à distance* with catgut threads.

3. Regeneration was from the central end, buds given off from the central axis cylinders growing toward the periphery.

4. The implanted substance serves only as a guide to the down growing axis.

5. Regeneration takes place most rapidly

(120 to 130 days in dogs) after implantation of a nerve segment.

Demonstration of a New Gas Pump for the Extraction of Blood-Gases. G. T. KEMP.

Dr. Kemp exhibited and explained the action of a new form of gas-pump. This pump is, except for slight modifications, a combination of the Sprengel pump with the Neeson and Bessel-Hagen additions to the Toepler pump. The large bulb is used in accordance with a suggestion of Pflüger and is about the size of those in the large pumps used in the laboratory at Bonn. The pump is made in two halves for ease of transportation. The vacuum space on each side of the bulb prevents the mercury from spitting back into the bulb, during the first few lowerings of the reservoir, as occurs in the Neeson-Bessel-Hagen-Toepler pump. The advantage of this form of pump over all patterns which have a 3-way stopcock at the top of the bulb, is that there is no danger of smashing the stopcock from the impact of the mercury, and the pump can be worked very much faster. No precaution has to be taken against raising the reservoir bulb too rapidly.

The Sprengel attachment can be made to work either separately or together with the other part of the pump.

There is no stopcock which is not completely under mercury seal, so that leakage is out of the question.

The essential requisite of such a pump is to extract all the oxygen as soon as possible, certainly before the blood clots, and to keep the tension in the blood bulb from rising above 20 mm. of mercury, as this prevents the complete disassociation of the oxygen from the oxyhaemoglobin. When blood is drawn into the vacuum the oxygen is given off very rapidly, in a 'puff,' so to speak, and the carbon dioxide is given off more slowly and regularly. By having a large Hg bulb which can be filled and emptied rapidly, the exhaustion can easily be main-

tained so as to keep the tension below 20 mm. of mercury, and after the oxygen is set free the Sprengel part is left working alone, and that carries off the CO₂, as it is slowly evolved, without necessitating close attention of the operator or the fatigue of raising and lowering the reservoir bulb of mercury. *Further Experiments Upon Equilibrium in Fishes.* F. S. LEE.

Previous work of Dr. Lee has shown that the organs of the sense of equilibrium lie in the ear, the semicircular canals mediating sensations of movements in curves, the otolithic parts sensations of the resting body. Recent experiments prove that the otolithic parts are, moreover, sensory organs for progressive movements, *i. e.*, movements in a straight line. Hence the ear deals with all three groups of equilibrium sensations of which the living body is capable.

Stimulation of the central end of the lateral nerve causes coördinated movements of the fins, analogous to those resulting from stimulation of the acoustic. This indicates that the organs of the lateral line are organs of equilibrium.

All experiments to prove that fishes possess a sense of hearing have so far given only negative results.

Equilibrium in the Ctenophora F. S. LEE.

Dr. Lee reported the results of experiments made under his direction by Mr. J. C. Thompson on the equilibrium phenomena of the Ctenophora. The normal animal exhibits definite positions of rest and definite coördinated movements. After removal of the otolith the resting positions are no longer maintained, and incoördination in movement appears. Forced movements do not result. If the body be cut into two parts, one with and one without the otolithic organ, the former maintains its equilibrium, the latter does not. All attempts to demonstrate a sense of hearing failed.

The two following papers, because of the lack of time, were read by title:

On changes of Structure in the Pancreatic Cell corresponding with Functional Change. A.

P. MATHEWS. (Introduced by F. S. LEE.)

On the Existence of Secretory Nerves. A. P.

MATHEWS. (Introduced by F. S. LEE.)

On Cardio-oesophagogeal Movements. S. J. MELTZER.

Dr. Meltzer has shown in a former paper that the outflow of arterial blood from, and the inflow of venous blood to, the thorax produce the cardiac movements which are obtainable from the pleuritic cavity as well from the trachea and the nose. In this paper he described the cardio-oesophageal movements arising from the same cause. He exhibited tracings which he obtained fourteen years ago from his own oesophagus, while studying the mechanism of deglutition. His recent studies were made on curarized dogs. By means of vagus inhibition the beginning and the end of each cardiac cycle were made recognizable. Nearly all the curves have the character of a 'negative pulse' and have no similarity either to a sphygmo- or cardiogram. The constant characteristic undulation seen at the beginning of each cardiac cycle are due to the movements of the auricle, which are more marked in the posterior mediastinum.

Cortex of the Brain: (a) Localization; (b) Development of. T. W. MILLS.

Dr. Mills undertook this research in connection with a study of the psychic development of young animals. It became necessary, however, as a precaution and guide in studying the functional development of cortical centres to make experiments on mature animals. While, during these experiments, most of the commonly accepted localization as set forth by Ferrier was verified in a general way, the results did not all harmonize with those of this investigator. Attention was called to details in the cortical motor localization of the rabbit and pigeon more especially, which were at vari-

ance both positively and negatively with those announced by Ferrier.

There had been found a great difference in the degree of cortical development of mammals not born blind as compared with those born with the eyes unopened; but as the work was not complete the author preferred not to make many very definite statements at the present time. Cortical development and psychic development took place *pari passu*.

The Active Principle of Rhus Toxicodendron and Rhus Venenata. FRANZ PFAFF. (Introduced by H. P. BOWDITCH.)

Dr. Pfaff stated that his experiments had been made with the assistance of S. Sanford Orr. He said that it is the general opinion that *Rh. tox.* and *Rh. ven.* contain a volatile proximate principle, which causes the well-known dermatitis venenata. Maisch's toxicodendric acid has been generally accepted as the active poison. P. and O. could not believe that a very volatile substance is the cause of the trouble, as this would be contrary to the pharmacology of vegetable skin irritants. They isolated Maisch's toxicodendric acid in the form of the barium salt, and found it non-toxic. The same is true of a solution of the free acid in water. As the real active principle they found a non-volatile oil. This oil, when applied to the skin, causes the well-known eruption. Photographs demonstrating the effect of the oil upon the human skin were shown. As preventive treatment P. and O. proposed a thorough washing with water, soap and brush, or, still better, a repeated thorough washing with an alcoholic solution of lead acetate. The oil being soluble in alcohol, and forming a nearly insoluble lead compound in alcohol, is thus best removed from the superficial skin. Further investigations will be undertaken, and an attempt made to classify Maisch's toxicodendric acid and the new poisonous oil, which seems to be of the kind called cardol,

obtained from *Anacardium occidentale*. These two oils are, however, not identical.

Inhibition Hypothesis in the Physiology of Respiration. W. T. PORTER.

Dr. Porter said that it is known that transverse division of the spinal cord between the bulb and the phrenic nuclei causes fatal arrest of the respiratory movements of the trunk. If death be prevented for a time by artificial respiration, the reflex powers of the cord gradually increase, and in the course of a few hours they may become so great that pinching the paws, blowing on the skin, suspending the artificial respiration, etc., may cause extended muscular contractions, including contractions of the respiratory muscles.

It is claimed that these contractions of the respiratory muscles after the separation of the cord from the bulb are proof that the respiratory impulse for muscles of the trunk is not derived from respiratory cells in the bulb but originates in the spinal cord. Against this hypothesis of spinal respiration is urged the fatal arrest of the respiration of the trunk caused by separating the bulb from the cord. It is replied that section of the cord stimulates inhibitory fibres in the cord and thus suspends the action of the spinal respiratory cells. This inhibition, it is assumed, usually lasts throughout the period of observation; in some animals, however, after long artificial respiration, it is partially overcome, permitting the respiratory contractions mentioned above.

The doctrine of prolonged inhibition of spinal respiration is easily overthrown by the following experiment. Hemisection of the cord usually arrests the contractions of the diaphragm on the side of the hemisection. (Exceptions are explained by 'crossed respiration.') This arrest is not an inhibition, for the diaphragm on the side of the hemisection begins at once to contract when the opposite phrenic nerve is cut. Hence, hemisection of the cord between the bulb

and the phrenic nuclei does not inhibit the the phrenic cells on the side of the section.

It follows that two hemisections, completely separating the cord from the bulb, do not inhibit the diaphragmatic respiration on their respective sides. The phrenic cells often send out no respiratory impulses after such a section because they receive none from the bulb. The phrenic cells cannot themselves originate respiratory impulses. Hence, the respiratory impulse does not arise in the spinal cord.

Demonstration—Hemisections of the Spinal Cord above the Phrenic Nuclei do not inhibit Thoracic Respiration. W. T. PORTER.

Acuteness of Vision in St. Louis Public School Children. W. T. PORTER.

The Weight of Dark-haired and Fair-haired Girls. W. T. PORTER.

Exhibition of Some New Forms of Galvanometers Suitable for Physiological Use, With Remarks Upon the Same. Prof. H. A. ROWLAND, at the Physical Laboratory of Johns Hopkins University.

Professor Rowland exhibited two new forms of high resistance galvanometers. One was a modification of the Thompson galvanometer, but less expensive in construction, and possessed a greater delicacy; the other was a modification of the D'Arsonval galvanometer, and was arranged with the observing telescope on a convenient wall support. It was shown that they were well adapted for laboratory use in Physiological work.

Demonstration of an Apparatus for the Plethysmographic Study of Odors, with Report of Results. T. E. SHIELDS. (Introduced by W. H. HOWELL.)

Mr. Shields exhibited his apparatus, and gave the following account of its use:

1. It consists of a device for holding the arm firmly in place in the Plethysmograph. Two hard rubber clasps, one fitting the wrist and the other the arm above the elbow, are rigidly connected by two metal rods. The

latter of the clasps fits against the Plethysmograph under the rubber membrane, where it is held in place by two other rigidly connected clasps, one against it outside the rubber membrane, and the other against the flange of the Plethysmograph.

2. A device for separating the pulse and vaso-motor curves. A short *wide* tube leads from the Plethysmograph to a vertical glass cylinder in which the water level can be made to register the pressure on the arm. Over the water is an air cushion connected with the tambour by a small tube through a piston movable in the cylinder. The motion of the piston controls the size and pressure of the air cushion. The lever of the tambour is made to move the point of an independently supported pen. A long *narrow* tube leading from the Plethysmograph dips into a test-tube of water swung from a delicate spiral spring. (Method described by Professor H. P. Bowditch.) A vertical thread from the bottom of the test-tube passes under a pulley, thence horizontally over a second pulley, and is held taut by a small weight. On its horizontal part is fastened a thin aluminum plate capable of holding a glass pen at right angle to the thread. The bulb of the pen is independently suspended by a vertical thread. The pendular motion due to the latter in the direction of the horizontal thread is so adjusted as to neutralize the curvilinear motion of the pen arising from the sag in the horizontal thread. The point of the pen may thus be made to describe a straight horizontal line. The resistance to the motion of the water in the *narrow* tube is sufficient to destroy all but vaso-motor effects; pulse effects are, in consequence, only felt through the *wide* tube.

The odors are contained in a series of bottles. The turning of a stopcock, which sends the constant current of air through any particular odor-bottle, at the same time, by an electrical arrangement, marks the in-

stant, and opens the terminal end of the corresponding tube near the subject's nose.

A pneumograph records the respiration. The pulse, vaso-motor and respiratory curves, the signal and time records (in seconds) are all traced in ink on a horizontal kymograph.

Explanation of Natural Immunity. GEORGE M. STERNBERG.

Dr. Sternberg, after a review of the experimental evidence relating to the cause of the natural immunity which exists among animals against parasitic invasion by various pathogenic bacteria and by putrefactive microorganisms, said that the experimental evidence submitted, considered in connection with the extensive literature relating to 'phagocytosis,' leads us to the conclusion that natural immunity is due to a germicidal substance present in the blood serum, which has its origin (chiefly at least) in the leucocytes, and is soluble only in an alkaline medium. And that local infection is usually resisted by an afflux of leucocytes to the point of invasion, but that phagocytosis is a factor of secondary importance in resisting parasitic invasion.

WARREN P. LOMBARD,
UNIVERSITY OF MICHIGAN. *Secretary for 1894.*

*AN INHERENT ERROR IN THE VIEWS OF GALTON AND WEISMANN ON VARIATION.**

WEISMANN'S name has become so intimately associated with the doctrine of germinal continuity that he is often regarded as its first advocate, although it is an old conception which has found expression in many writings.

Among others I myself stated it in the following words in a book printed in 1883, before the publication of Weismann's first essay on inheritance.

"The ovum, like other cells, is able to reproduce its like, and it not only gives rise,

during its development, to the divergent cells of the organism, but also to other cells like itself. The ovarian ova of the offspring are these latter cells or their direct unmodified descendants."

After the appearance of Weismann's essays, and the revival of discussion on the views of Lamarck, I was much surprised to find my book referred to as a Lamarckian treatise, and my reason for quoting this passage now is not to claim priority, but to show that, in 1883, I, like Weismann, attributed inheritance to germinal continuity.

I may take this occasion to say that I still regard inheritance as a corollary or outward expression of the continuity of living matter, although I am less confident than I was in 1883 of the importance of the distinction between somatic and germinal cells. So much for the doctrine of germinal continuity.

Passing now to another topic, we find that the two most prominent writers on inheritance, Weismann and Galton, base their views of variation on the assumption that, at each remote generation, the ancestors of a modern organism were innumerable, although a little reflection will show that this assumption is untenable.

Weismann, at least in his earlier and simpler writings, finds the cause of variation in the recombination, by sexual reproduction, of the effects of the diversified influences which acted upon the innumerable protozoic ancestors of each modern metazoon.

If it can be proved that these protozoic ancestors were not innumerable, but very, very few, and that these few were the common ancestors of all the modern metazoa, his position is clearly untenable.

Galton's view of the cause of individual diversity is very similar to Weismann's. He says: "It is not possible that more than one-half of the *varieties* and number of the parental elements, latent or personal, can on the average subsist in the offspring.

* A paper read, by invitation, at the meeting of the Society of Naturalists, in Baltimore, Dec. 27, 1894.